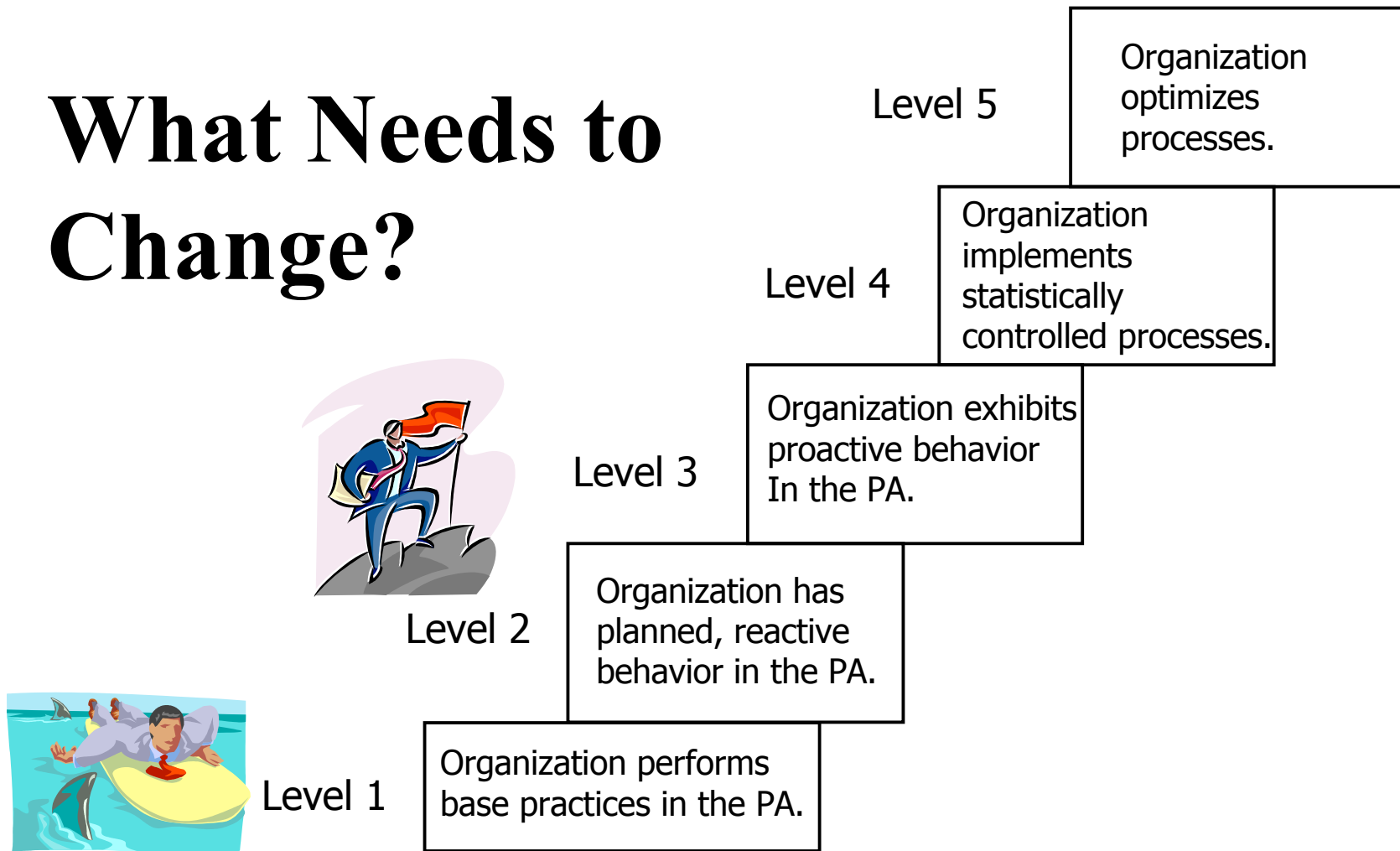


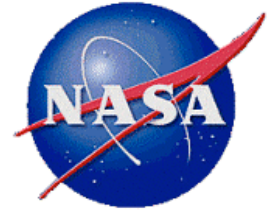
Getting to CMMI Level 2:

What Needs to Change?





Agenda



What is this CMMI stuff?

Why are we doing this?

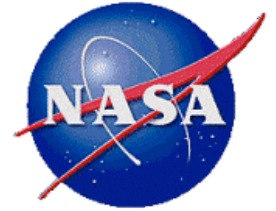
Who needs to get to Level 2 anyway?

What needs to change?

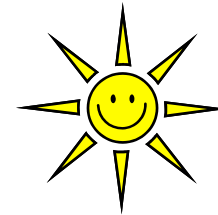
- More process focus
- More consistency across projects
- More emphasis on planning
- Use of measures to improve monitoring
- Better status reporting
- More recording of “artifacts”
- And some other things

Basic rules for success

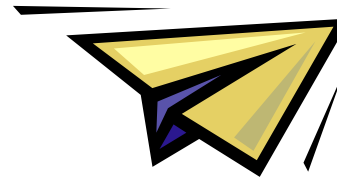
What is this CMMI stuff?



A Cat and Mouse Game?



**Something to Keep the
Managers Happy**



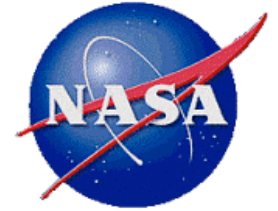
A New Type of Spacecraft?



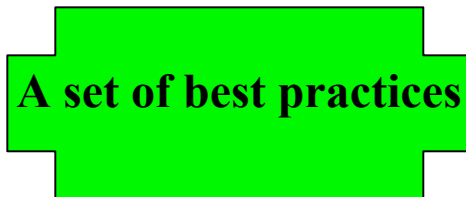
**A New Edict, Let's see-- There was
TQM, then ISO, now CMMI?**



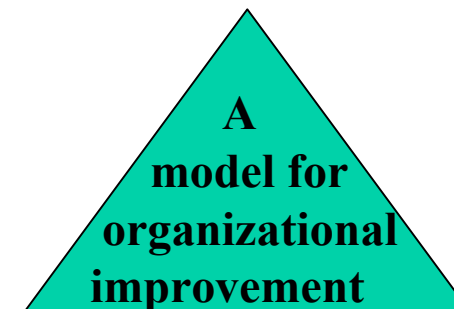
Seriously, Now--- CMMI is:



The Capability Maturity Model Integrated (CMMI) is an integrated framework for maturity models and associated products that integrates the two key disciplines that are inseparable in a systems development activity: software engineering and systems engineering.

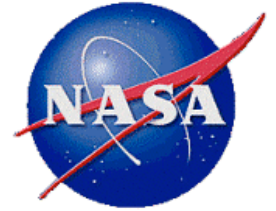


**A common-sense application
of process management &
quality improvement concepts**





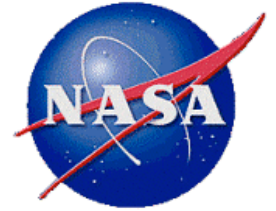
Why Use CMMI?



- In software and systems engineering, it is a **benchmarking tool** widely used by industry and government, both in the US and abroad.
- CMMI acts as a **roadmap** for process improvement activities.
- It provides **criteria** for reviews and appraisals.
- It provides a **reference point** to establish present state of processes.
- CMMI addresses practices that are the **framework** for process improvement.
- CMMI is **not prescriptive**; it does not tell an organization how to improve.



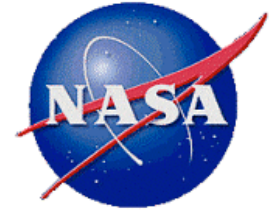
Why Are We Doing CMMI?



- Because it's good for you????
- Required by NASA Directives:
 - NPD 2820.1
 - NPR 7150.2 requirements
- Shown by Industry to have many benefits



Project Performance vs. CMM Level (General Dynamics)

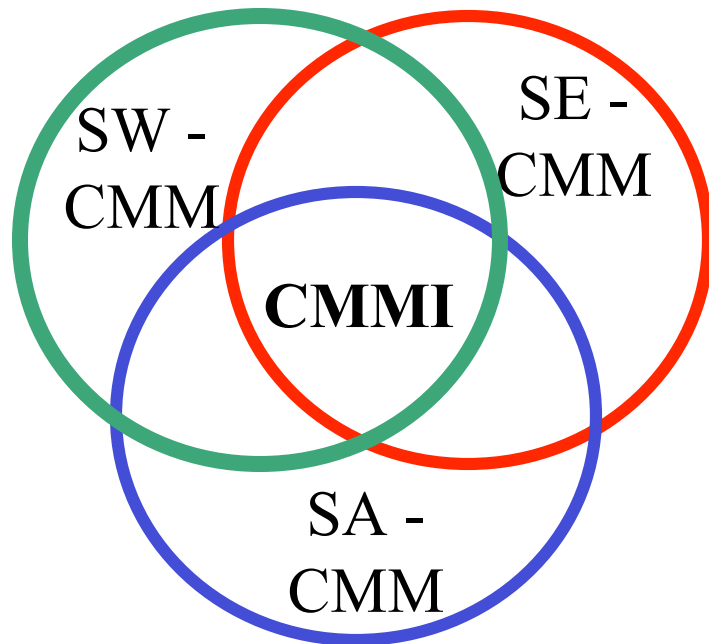
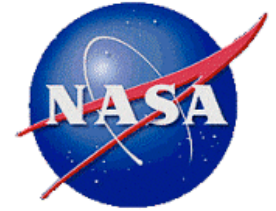


CMM Level	Percent Rework	Phase Containment Effectiveness	CRUD Density per KSLOC	Productivity (X Factor Relative)
2	23.2%	25.5%	3.20	1x
3	14.3%	41.5%	0.90	2x
4	9.5%	62.3%	0.22	1.9x
5	6.8%	87.3%	0.19	2.9x

Diaz, M. & King, J., "How CMM Impacts Quality, Productivity, Rework, and the Bottom Line", Cross Talk: The Journal of Defense Software Engineering, March 2002. General Dynamics Decision Systems, 3 Divisions, 1,500 Engineers / 360 SW Engineers, CRUD = Customer Reported Unique Defects, Largest RIO found to be from levels 2 to 3 at 167% based on cost savings in rework.

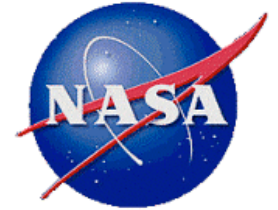


Capability Maturity Model Integrated (CMMI)-Staged



Level	Process Areas
5 Optimizing	Organization innovation and deployment Causal analysis and resolution
4 Quantitatively Managed	Organizational process performance Quantitative project management
3 Defined	Requirements development Technical solution Product integration Verification Validation Organizational process focus Organizational process definition Organizational training Integrated project management Risk management Decision analysis and resolution Integrated Supplier Management Integrated Teaming
2 Managed	Requirements management Project planning Project monitoring and control Configuration Management Supplier agreement management Measurement and analysis Product & Process Quality Assurance
1 Initial	

Who Needs to Get to Level 2?



Domain	FY04	FY05	FY06	FY07	FY08
Flight Software Branch		Level 2	Level 3		
ISD & Code 400 Mission Software			Level 2	Level 3	
Any Code 600/900 Mission Software not previously included				Level 2	Level 3

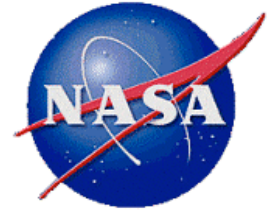
Schedule for achieving CMMI levels in different domains

What if I'm not doing "mission software"?

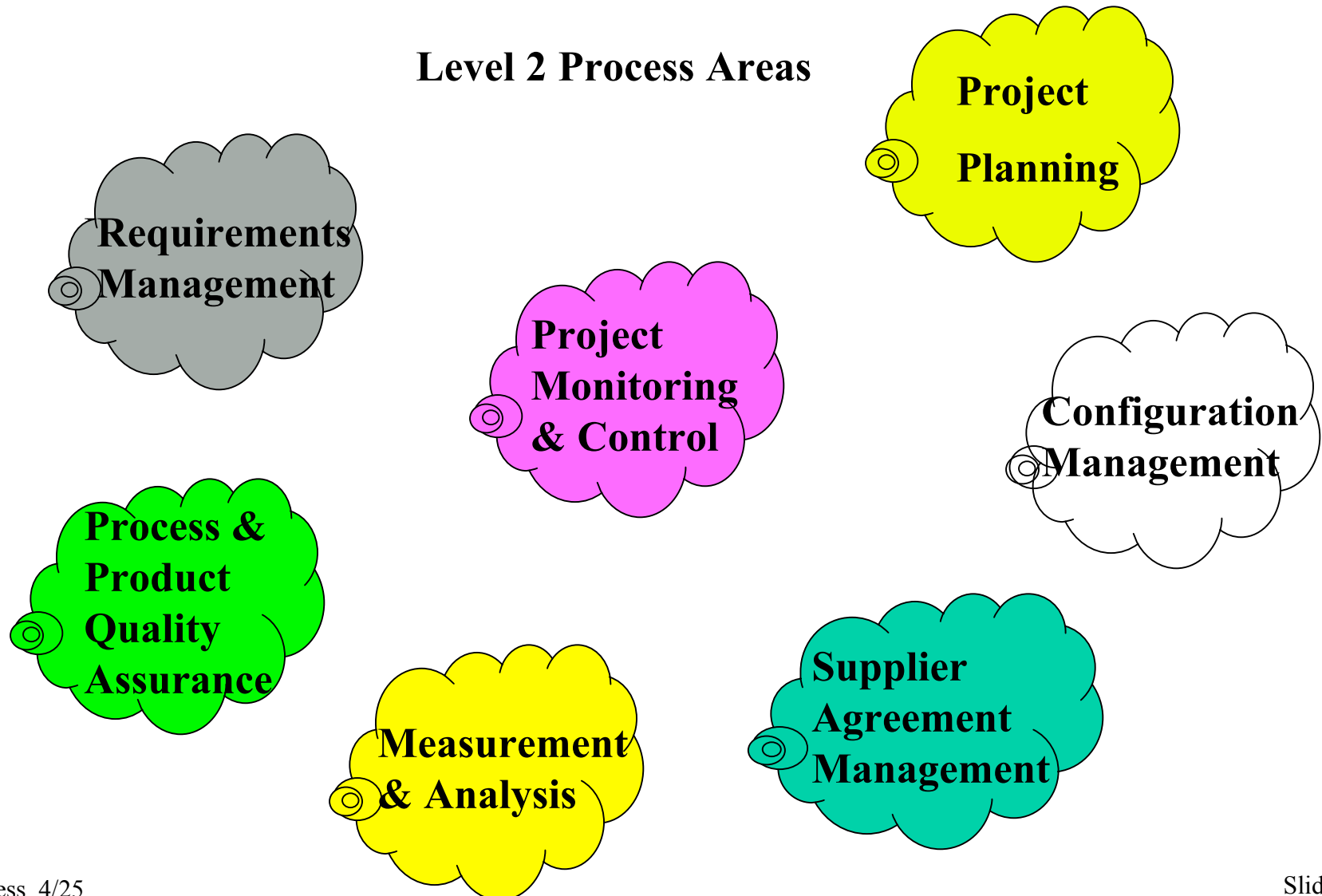
- CMMI Level 2 practices are "best practices"
- Everyone is strongly encouraged to consider using improved practices

So---It's not just for Flight Software!

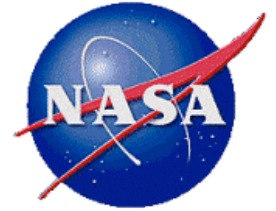
Starting with Level 2



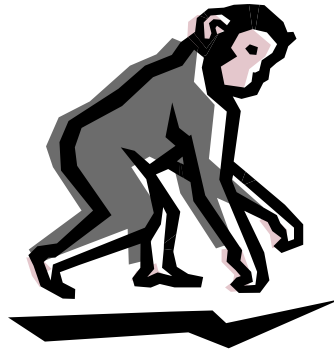
Level 2 Process Areas



What Needs to Change?



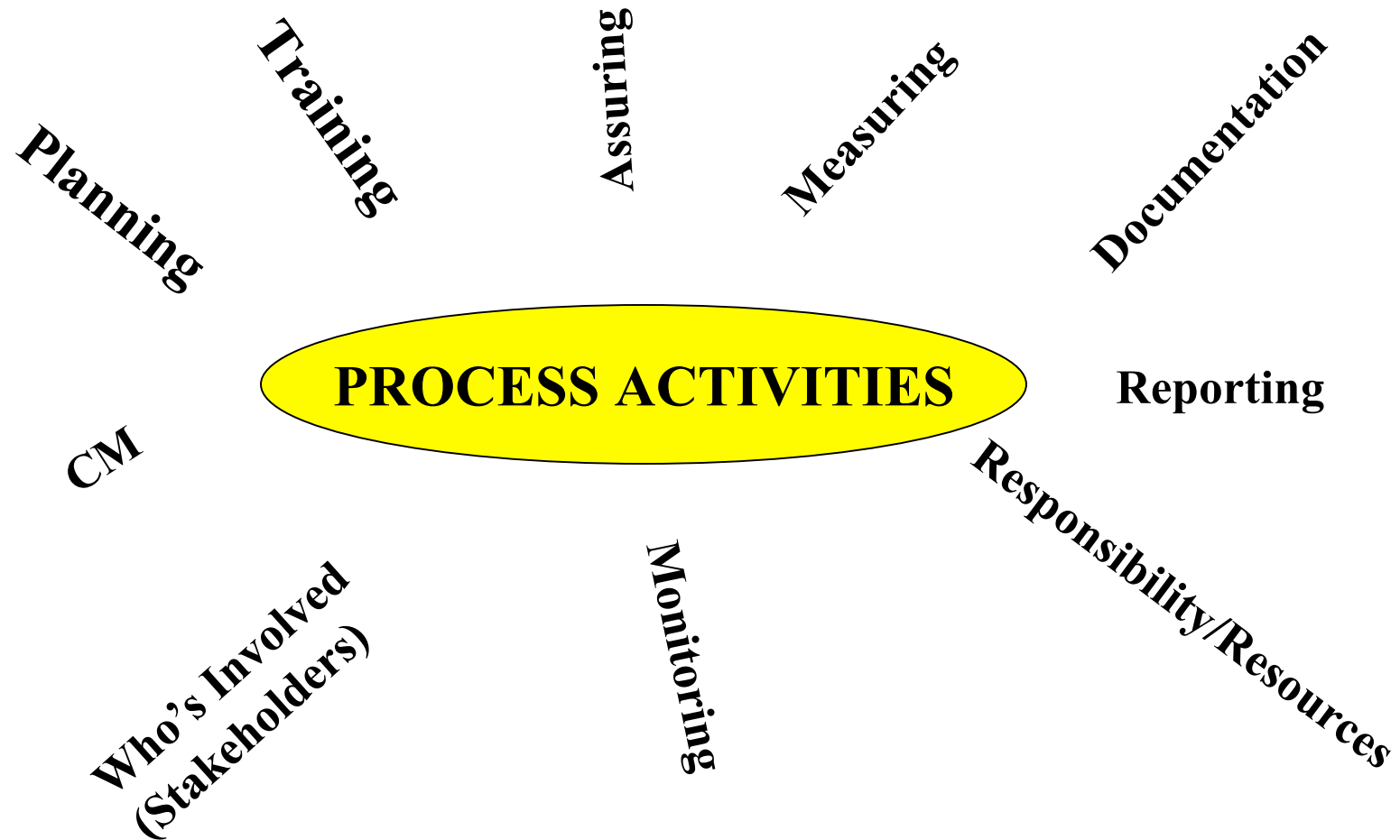
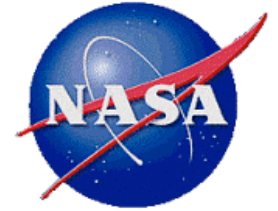
Our 10,000 lb gorilla is:



Not enough attention to PROCESS activities!

Process: documented expression of a set of activities preformed to achieve a given purpose

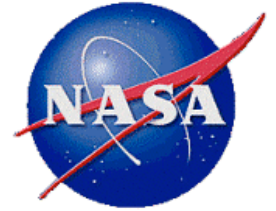
What Needs to Change? Process Focus





What Needs to Change?

An Example of Process Focus



Project Planning

Plan for a Plan:

What activities need to be completed for project planning?

What is the schedule? End products? (WBS, Staffing plan, SMP)

Responsibility/Resources:

Who is responsible for planning? Are there allocated resources?

Training:

Trained on planning process? On how to do project planning?

Monitoring/Measuring:

Is planning on schedule? Are planning products getting done as planned ? How much effort are we spending on planning?

Who's involved (Stakeholders):

Does the planning depend on others? Who else should review?

CM: Are planning products under appropriate control?

Assuring: Is anyone checking to see that planning process is followed?

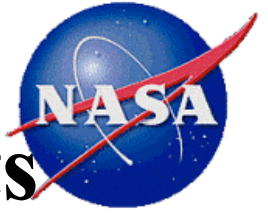
Reporting: Are we reporting on planning activities?

Documentation:

Have the artifacts been saved to “prove” we did everything above?



What Needs to Change? More Consistency Across Projects

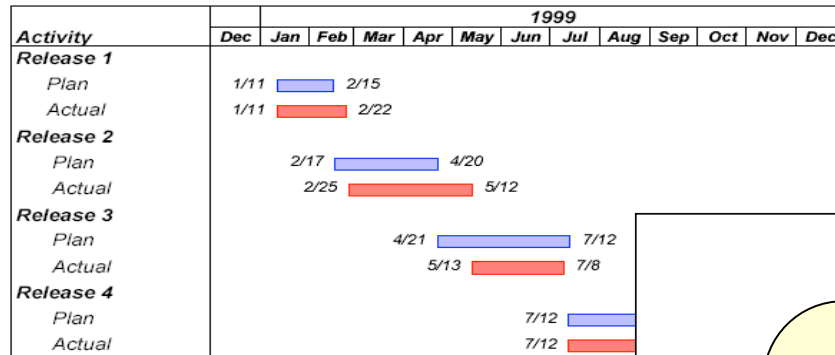


- All projects in an organizational group will use same processes
 - Projects can tailor processes using guidelines in organizational processes
- ISD has a new software development policy:
See: <http://software.gsfc.nasa.gov/>
- ISD will have a consistent set of approved processes for all CMMI Level 2 process areas
 - Already in place: Project Planning, Project Monitoring and Control, Configuration Management
 - Coming soon: Requirements Management, Measurement Guidelines for Projects, Guidelines for Software Assurance, Acquisition Processes
 - Flight Software has tailored versions
 - Processes can be found at: <http://software.gsfc.nasa.gov/>

What Needs to Change?

Better Measurement for Monitoring

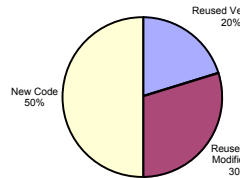
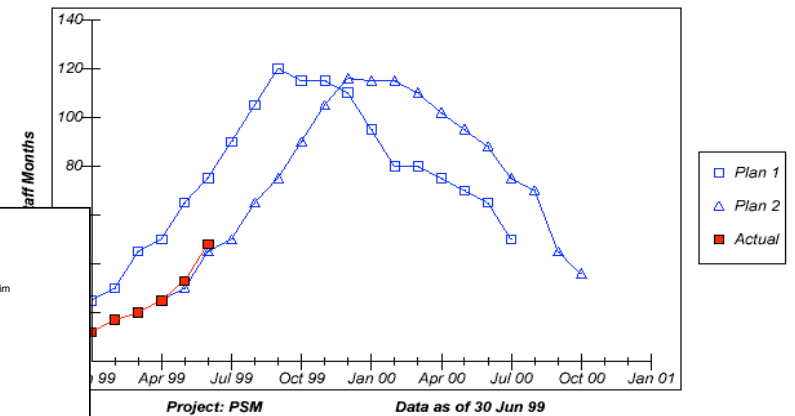
Milestone Progress
Maintenance Activities



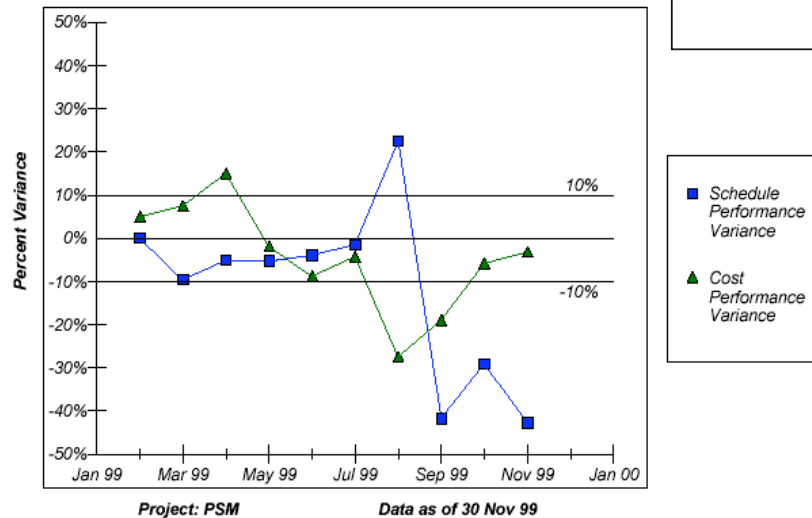
Project: PSM

Data as of 15 Oct 99

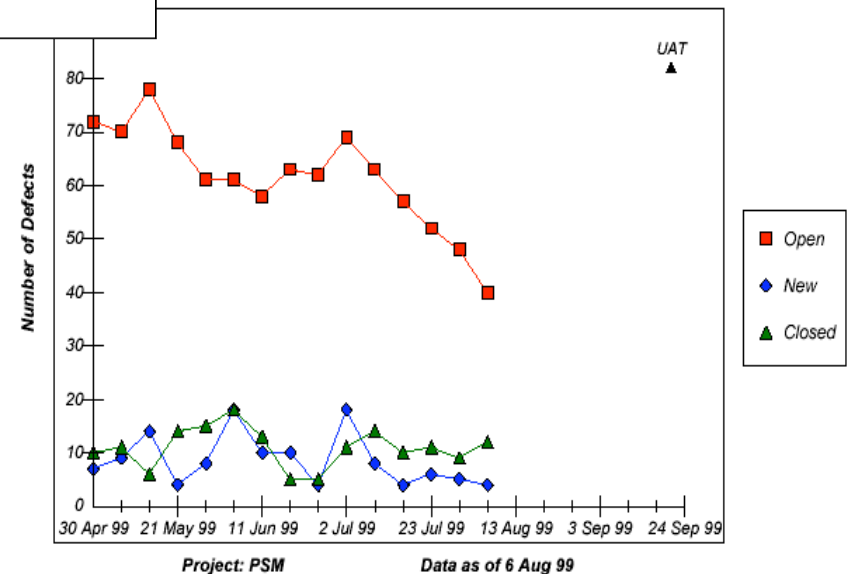
Effort Allocation
With Replan



Cost and Schedule Performance



Status of Severity 1 Defects



What Needs to Change?

Better Measurement for Monitoring



Planning for Measurement:

- Why do we want to measure? (Objectives?)
- What should we measure?
- How to measure? Where to store measures?
- What does the data tell me?

Reporting on Measurement:

- Include measures in status reports, reviews

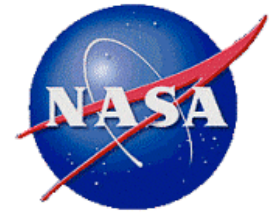
Don't forget to measure process aspects!

Document planning information!





What Needs to Change? Better Status Reporting



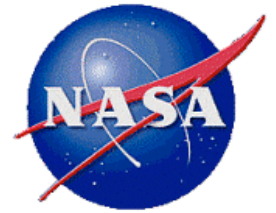
- Report activities against plans
- Include measures (think earned value, point counting)

**What do you mean where are we?
It's Tuesday, we must be in Build 2**

- Report risks, changes in risk status, implementation of mitigation plans
- Report changes in planning parameters (cost, schedule, effort)
- Don't forget to report on process activities!



What Needs to Change? Better Recording



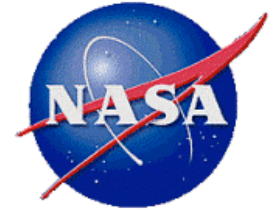
- Must be able to show what you do
- Document and save **MOST EVERYTHING!**
- Examples of evidence:
 - Trade studies
 - Decision logs
 - Action item lists (with closure info)
 - Peer review planning items, results
 - Planning information
 - Proof of review or commitment
 - Stakeholder involvement (attendance, etc.)



**SAVE THAT
MAIL**



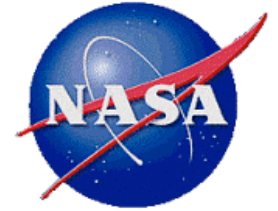
What Needs to Change? Some Other Things



- Configuration Management:
 - Planning and Documentation for CM (Identify CM items)
 - CM Audits
- Requirements Traceability:
 - Need bidirectional traceability
- Project Monitoring and Control:
 - Be sure to monitor AGAINST PLAN
- Project Planning:
 - Need to keep basis of estimate materials
 - Have WBS with activities described, estimate work products
- Quality Assurance:
 - Need to assure both products and PROCESSES
 - Check against processes, procedures, standards



Basic Rules for Success

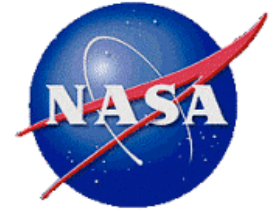


1. Plan (& document) all project activities
 - Usually plan and document product life cycle events
 - Also need to plan process activities

Examples:

- QA audits
- CM audits
- Establishing a CM system, CCB's etc.
- Planning events: completing cost estimate, identifying team, training, drafting plan

Basic Rules for Success



2. Document, Document, Document

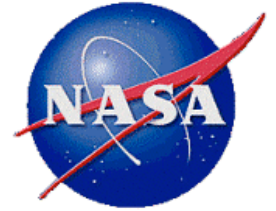
- Organize all project documentation---

Examples: decision logs, emails, trade studies, meeting minutes, action items, results, product documentation, etc.

- Some needs to be under CM, some just kept in an organized fashion
- Don't forget to document YOUR project's process (any tailoring you do of other assets)

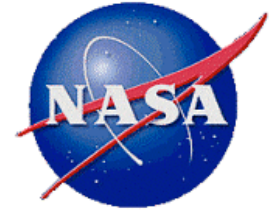


Basic Rules for Success



-
3. Identify “who does what”, “people interactions” and ensure training
 - Document responsibility of those on your team (include process activities)
 - Identify anyone else who needs to be involved
 - Make sure everyone is trained
 - “Body of Knowledge “ training
 - Process Training

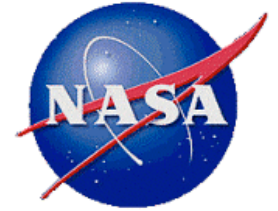
Basic Rules for Success



4. Monitor, Measure, & Report project and process activities
 - Periodically monitor against plan
 - Don't forget process activities
 - Measure: Think in terms of planned/ actuals and status of process activities
 - Report periodically to line management and higher level project management



Basic Rules for Success

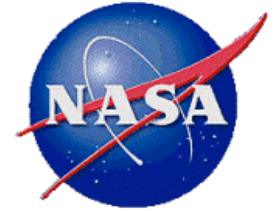


-
5. Use quality assurance to check that project activities are being performed as planned
 - All projects need “objective evaluation”
 - Plan and document quality assurance activities
 - Check both product/processes
 - Are you doing activities as planned?
 - Are you following project/branch/ISD/Center processes, procedures, standards



Summary

1 of 2

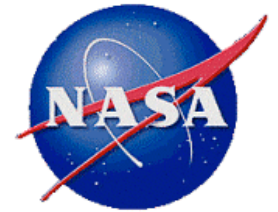


Key improvements for Level 2:

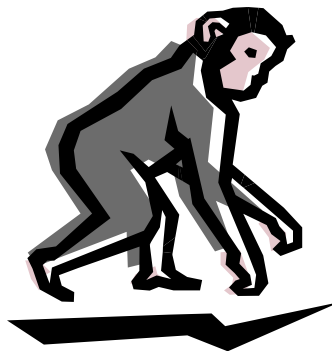
- Pay more attention to process activities
- Follow basic rules:
 - Plan and document all project activities
 - Document, Document, Document
 - Identify “who does what”, “people interactions”, ensure training
 - Monitor, Measure, Report all project activities
 - Use quality assurance to check that project activities are being performed as planned

Summary

2 of 2

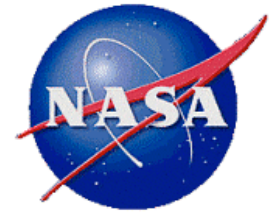


- Plan your measurement program
- Maintain bi-directional traceability
- Do CM audits
- Monitor stakeholder involvement, organization and storage of project documentation, process activities
- Document/Maintain basis of estimates
- Do objective evaluation of process activities

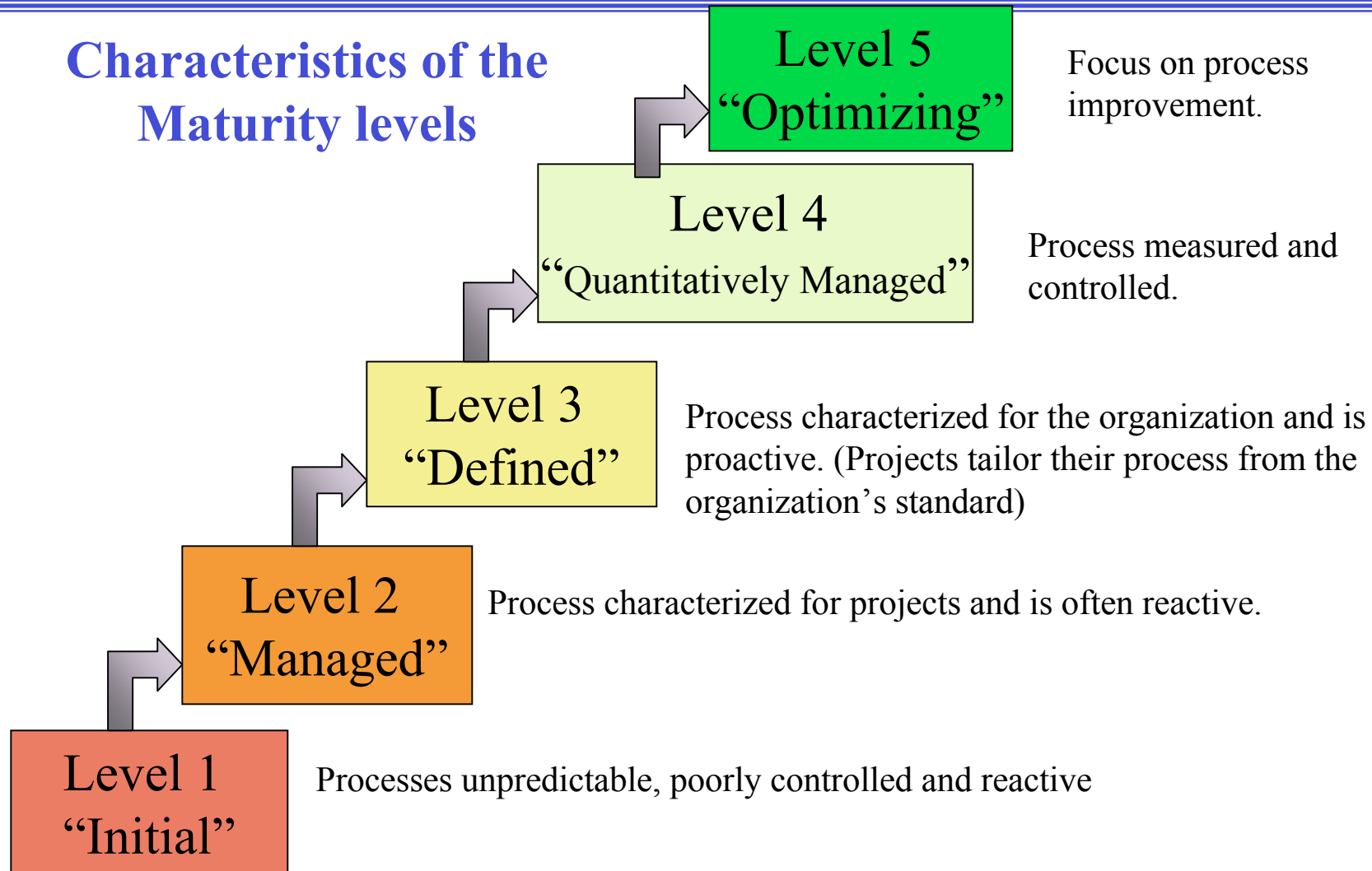


Back-up Slides

Capability Maturity Model Integrated -Staged



Characteristics of the Maturity levels



CMM was developed by the Software Engineering Institute (SEI), Carnegie Mellon University (CMU)

Components of CMMI Model

